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VIEWS, NEWS AND INTERVIEWS.

Mr. Siemens, the electrical engineer, was in Ottawa, Canada, last week, and has made a proposition to lay the proposed cable from Victoria, B. C., to Sydney, N. S. W. He will guarantee to complete the work within three years, and says that his expenses will be less than any other bidder's. His offer is being considered by the Dominion Government.

There has long been a marked tendency among lawyers to abandon the wide field of general practice and take up with "specialties," some devoting themselves to mercantile, others to accident, to corporation, to insurance and to criminal cases. Within a comparatively short time there has sprung up in New York a class of practitioners known as "electricity lawyers." These are either young men who, coming to the bar, find the field of professional employment crowded, or men of middle age, who, retained in cases wherein electricity figures, have become experts on similar questions.

"As illustrating the absent-mindedness of the electrical inventor," said a man, "I'll tell you this. Last October an electrical engineer and inventor whom you all know went to his New York tailor and ordered a new dress suit. He made an appointment to have it tried on and promptly forgot all about it. He wore his old dress suit on occasions during the Winter and complained of its appearance and said that it was too small every time he put it on. Finally, in March he received a note from his tailor asking what disposition should be made of the dress suit ordered in October. Then he remembered his appointment to try it on."

"The tariff bill has reached another stage," remarked an electrical contractor, "but whether its passage by the Senate means an early final settlement or another contest is not easy to judge. The report from Washington that the bill does not meet the wishes of the President is important, if true. No improvement in the general situation can be looked for until tariff tinkering ceases and the labor problem is satisfactorily adjusted."

The gigantic wheel now in course of construction at the Earl's Court Exhibition, London, is to be lighted by 280 incandescent lamps, 160 of which will be fixed in the 40 cars.

"Thy Name Is Woman," by Olive B. Muir, is one of the latest novels. Miss Muir, the author, is the daughter of Mr. John Muir, who was general manager of the railway department of the Edison General Electric Company, and latterly manager of transportation for the General Electric Company.

The Northern Society of Electrical Engineers (British) have arranged for an excursion to the Antwerp Exhibition on July 20. The party will return from Antwerp on July 23.

A Frenchman, M. Bersier, has devised a plan by which the compass performs the part of the helmsman. An electric current is placed to work on the desired course, and when the vessel gets off the course for which the electrical instrument is set, the current starts a motor in either direction and moves the rudder until the vessel returns to her proper course. A two months' trial of the apparatus is reported to have resulted very successfully. Among the advantages of this new method is greater accuracy and no loss of distance in a run of 24 hours, as is usually allowed.

President John E. Hudson, of the American Bell Telephone Company, has been made a director of the International Trust Company, of Boston.

THE INVENTOR OF THE ELECTRIC FAN MOTOR.

DR. SCHUYLER S. WHEELER BELIEVES HE'S THE MAN—A LITTLE ANCIENT HISTORY OF SMALL ELECTRIC MOTORS.

God certainly should bless the man who first conceived the electric fan.—ELECTRICAL REVIEW, June 27, 1894.

Dr. Schuyler S. Wheeler, of the Crocker-Wheeler Electric Company, of this city, noticed the above paragraph in the ELECTRICAL REVIEW and being an aspirant, with the rest of us, for heavenly blessings, put on his thinking cap. After a little cogitation and reference to an old scrap-book he believes he is the man who invented the electric fan and, consequently, is entitled to the especial blessing invoked by the ELECTRICAL REVIEW.

"C. & C." SEWING MACHINE MOTOR FROM WHICH THE ELECTRIC FAN MOTOR WAS EVOLVED.

In Dr. Wheeler's scrap-book is pasted a little pink folder advertising the fact that the "C. & C." Electric Motor Company, Room 18, Tribune building, New York city, were prepared to furnish an electric motor and battery outfit to operate sewing machines. On the first page of the folder was a picture, which is reproduced herewith. This pink folder, the "C. & C." company's first advertisement, was issued about April or May, 1886. The "C. & C." Electric Motor Company were about the first motor makers of consequence in this country, and Dr. Wheeler was their electrician and superintendent.

"One day," said Dr. Wheeler to an ELECTRICAL REVIEW representative, "I suggested turning the sewing machine form of motor upside down, so as to bring the shaft up higher and putting on a 'thing like a propeller.' Then I sketched out a piece to replace the yoke. (See 'A' in the illustration.) This piece had three feet carved like an animal's paws, each paw having three toes. I remember that it was a very momentous question at that time whether there should be three or four toes. The Jackson Architectural Iron Works made up these iron pieces for us. The combination attracted considerable attention and we immediately began making the fan outfits as a regular article. Then the other companies took up the idea. We used a 12 inch, six blade fan and an Edison incandescent lamp on top of the motor for resistance. I estimate the number of electric fans made since then at 25,000."

In this connection it will be interesting to note how the "C. & C." motor came into existence. It was invented through the fact of Mr. Roberts, of the Roberts-Brevoort Battery Company, coming to Messrs. Curtis & Crocker, as experts, and saying it was a pity there was not a correctly designed small motor in existence; that he had just perfected a very good power battery with which he could run sewing machines and do other work if he only had a motor with any degree of efficiency whereby he could convert a large enough percentage of his battery power so that he would equal the work of the sewing machine. They replied that there was no difficulty in getting up such a motor and that it was remarkable that it had not been done before and that they would undertake it. They got up such a motor, and when it was tried the result was not satisfactory. This surprised them very much as they were confident of the correctness of their calculations, and upon close investigation they found that the battery did not give a current and maintain its electro-motive force as claimed, but that the motor when supplied with the expected current would give the required power. They then found themselves in possession of a good motor but without a battery to drive it, and consequently to make an operative outfit were obliged to undertake the design of a battery. This was successfully accomplished,

producing the "C. & C." plunge battery, which, together with the motor made a very successful sewing machine outfit. About this time Dr. Wheeler left the Herzog Teleseme Company and joined Curtis & Crocker in this business. After getting up the first 150 machines, which were for the late Joseph B. Stearns, of Boston, of telephone fame, one of the first things Dr. Wheeler did was to invent the electric fan motor as told above.

It is rather a curious fact that the same mistake as made by Edison was made in the first "C. & C." motor of making the field magnet cores and coils about twice as long as necessary.

TELEPHONE NEWS AND COMMENT.

The Southeastern Massachusetts Telephone Company has given orders to a Boston architect to prepare plans for a two-story exchange building to be erected in the Spring at Taunton, Mass.

The telephone service in Elizabeth, N. J., was badly damaged by lightning recently. The operators in the central office were driven from the switchboard, at which all the fuses were burned out.

Clarence G. Mead, promoter of the new telephone company at Ridgefield, Conn., says that service will be inaugurated within three weeks. The Southern New England Telephone Company has an exchange in the town.

The long distance telephone line being constructed from Pittsburgh to St. Louis by the American Telegraph and Telephone Company is rapidly nearing completion. Within a fortnight it is expected that there will be through service from New York to St. Louis.

General managers and superintendents of the Erie Telephone & Telegraph Company were at Lowell, Mass., last week in consultation with the board of directors in regard to the contemplated extension of the telephone service in their respective divisions.

Chicken thieves hung a chicken on a cable near where it entered a cable house belonging to the Southern New England Telephone Company. They then built a fire under the chicken and roasted it. The cable and cable house were damaged to the extent of $1,000. The thieves ran away and left the chicken behind them.

Capt. George N. Stone, the general manager of the telephone company at Cincinnati, O., is perfecting arrangements for mounting all inspectors and line repairers on bicycles, instead of having them patronize street cars or "shanks' mares" as heretofore. This is a move in the right direction, and is in full accord with an enterprising management that has given Cincinnati the splendid telephone service it enjoys.

THE LOAD LINE IN TELEPHONE EXCHANGES.

ABSTRACT OF A PAPER READ BEFORE THE AMERICAN SOCIETY OF CIVIL ENGINEERS, JUNE, 1894, BY A. V. ABBOTT.

The shape of the load line in any exchange is evidently governed partly by the speed and facility with which the operators are enabled to perform the various evolutions described as necessary to make connections between the subscribers, and partly by the nature of the business done by the exchange. The work done by the operator thus becomes an important governing factor in the load line.

The business of the exchange is complicated by the frequent necessity of trunking calls between outlying offices, for the growth of the exchange soon leads to the establishment of a number of branch offices connected between themselves and to the original center by means of trunk cables. When a message proceeds through two offices it must, of necessity, pass through the hands of two operators and through two switchboards. To accomplish the business thus transferred, it is customary to locate in front of every operator a certain number of trunk lines extending to all the other offices in the exchange. At the receiving end the trunks from the through offices are brought to special sections of the switchboard devoted to trunking business alone. In the trunking sections no subscribers' drops are placed, the attention of the incoming trunk operators being devoted entirely to receiving connections over the trunk lines and completing them on the multiple located in front of them.

To determine the load line it is now customary in nearly all the larger American exchanges to make frequent tests of the amount of business. To this end recourse is had to what is termed the "operator's peg count." In front of each operator is placed a panel containing the subscribers' spring-jacks, each one bearing an appropriate number. The operator is supplied with a wooden peg, which at the commencement of the count she inserts in jack 0. As fast as calls are received she moves the wooden peg from hole to hole, counting calls something after the fashion of a cribbage board. At the end of each hour the superintendents in the operating room note the position of the peg, thus determining the number of calls which have been received by the individual operators. At the end of the day the sheets bearing the facts thus obtained are tabulated, and the results plotted in a convenient form for inspection.

A chart of the business transacted in a week by the main office of the Chicago Telephone Company shows some interesting data. At the time this count was made this office embraced about 5,000 subscribers, while the entire exchange numbered some 10 offices, including about 10,000 subscribers. From midnight to 7 o'clock on Sunday morning little business was done by the exchange, the number of calls in any one hour barely reaching 100. From 7 to 10, the business steadily increased, reaching at 10 o'clock a maximum of about 350 calls per hour. Another maximum occurs between 12 and 1, reaching about 375 calls. From this point the business steadily decreases, reaching a minimum between 2 and 3 on Monday morning. From 3 o'clock to about 7 there is a slight increase. At 7 o'clock the business of the day begins, the number of calls rising rapidly from 200 per hour at 7 o'clock to a maximum of 6,920 calls an hour at about 10.15. From 10.15 to 12.30 the business decreases, being reduced to 4,150 calls per hour during lunch time. From 12.30 to 2.15 the business again increases, reaching a second maximum of 5,950 calls. From this point a rapid decrease occurs, to the rate of about 500 calls an hour between 7 and 8 o'clock in the evening. The curve at this point turns and slowly decreases again until about midnight.

FIG. 1.—A GROUP OF WESTINGHOUSE STOPPER INCANDESCENT LAMPS.

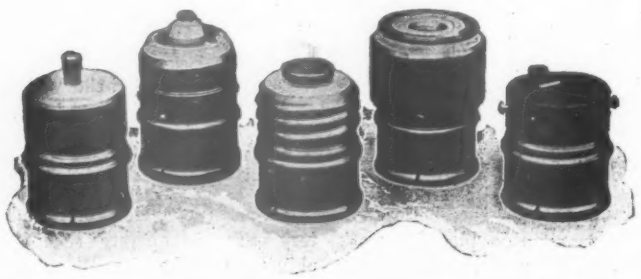

FIG. 2.—ADAPTERS FOR WESTINGHOUSE STOPPER INCANDESCENT LAMPS.

Between 2 and 3 o'clock a slight increase takes place, due to newspaper business, while the minimum of the entire 24 hours is reached at 4 A. M., at a rate of about 50 calls an hour. Rather more business is done on Monday than any of the succeeding days, with the exception of Saturday. During Tuesday, Wednesday and Thursday the business decreases, reaching a minimum on Thursday. On Friday a slight increase occurs, while on Saturday the effect of the Summer half holiday is plainly marked. Here it is evident that an effort has been made to transact the entire business of the day in the forenoon, the maximum being reached at 11 A. M., with a rate of about 7,600 calls an hour. From 11 A. M. the business drops sharply, there being no indication of any noon hour, but the holiday effect is also noticeable in an increased number of calls made during the evening hours, from 6 to 9 o'clock. A study of the load line is particularly advantageous in adjusting the operating force to the business of the exchange in a way to make the quantity and quality of the service a maximum with a minimum of operating expense.

In a like manner the study of load lines forms an exceedingly valuable source of information in the location of branch exchanges and the distribution of subscribers' lines. The trunking of calls between branch offices has already been alluded to. It is quite evident that the establishment of branch exchanges increases the cost of operating, as it requires the expense of additional buildings, additional supervision and a general increase in the non-productive por-

tion of operating expenses. Where, by means of a branch exchange, the capital invested in the subscribers' lines may be decreased by shortening those lines, resulting in such a saving as to warrant the increase in operating expenses, a branch exchange becomes profitable. On the contrary, if the business in the district covered by the branch exchange is of such a nature as must necessarily come to the main office, the establishment of a branch exchange must be supplemented by such a large number of trunk lines as practically to extend the line of each subscriber into the main office. Thus, under such circumstances, the establishment of a branch exchange becomes an impediment rather than an assistance; as the speed of the service is reduced, greater expense is incurred, and no particular saving can be made in the capital expended.

The improvement in service which has resulted to the Chicago company during the past six months from investigations of this description has been so marked that a regular system of peg counting now forms one of the features of the operative service of the company, regular counts being made on the tenth of each month. A special count takes place whenever circumstances of so peculiar a nature arise as to seem worthy of investigation.

The Westinghouse Stopper Incandescent Lamp.

The Westinghouse stopper incandescent lamp which first came into prominence in an endeavor to fill the demands for the electrical illumination at the World's Columbian Exposition, and which saved the Columbian Exposition Company a round million dollars from the figures submitted by other companies, has been very materially perfected since it was first brought out and the Westinghouse Electric and Manufacturing Company are now prepared to put it on the market in competition with all other makes in the firm belief that it will more than fulfill their claims of excellency in life, efficiency and maintenance of candle-power.

During the time of the World's Fair and in fact ever since the lamp was first put on the market there has been more or less speculation in regard to it among the trade and a general feeling of doubt as to its practical utility and economy of operation. There is no doubt that the lamp as first gotten up for the purpose of securing the contract at the Fair was susceptible to a number of improvements to make it of commercial utility, but the Westinghouse company were firm believers in its ultimate future and were convinced that many good features were embodied in its construction.

Following out the line of their usual business policy they have persistently worked at the perfection of every detail and have at last reached a point where they can guarantee that the lamp now offered to the trade is fully equal and in some respects far superior to any lamp that has yet been offered to the trade.

As economy of manufacture in incandescent lamps, as in anything else, is one of the chief factors in its commercial value, the Westinghouse company have started from the beginning with the idea of turning out each individual part in the most perfect and yet most economical manner. Special machinery has been designed and built for this purpose, and they now manufacture in their own works every part, from the glass bulb to the finished article. This work is carried on under the immediate supervision of their own experts and in the most thorough manner. By this means they are enabled to dispose of the lamp at the uniform price of 25 cents for 8, 10 and 16 candle-powers, subject to special discounts to users of their apparatus and also to a rebate of four cents on the return of each lamp with unbroken bulb and stopper.

In making preparations for the amount of trade they expect to handle under these conditions, they have greatly increased their capacity and are now prepared to supply lamps in very large quantities at short notice.

The general construction of the Westinghouse lamp is already too well known to need a lengthy description. One of the chief features which this style of lamp has made practicable is the substitution of iron leading-in wires for the platinum wires necessary in the old style. This has necessarily greatly reduced the cost of manufacture, and in addition to this the present construction has made it possible to substitute machine work for manual labor to an extent heretofore regarded as impossible in lamp manufacture. This fact besides cheapens the cost of production and tends to insure greater uniformity in the product. One of the chief criticisms that has been brought against all types of incandescent lamps in general use is that from the very moment they begin to burn they begin to lose in candle-power, consuming practically the same amount of energy no matter to how low a figure the amount of light given may have fallen. Heretofore for certain well-known reasons the 50 volt type of lamp has been assumed as the standard of excellency, its superior character in many cases being estimated as more than counter-balancing such objections as the increased cost of wire, etc., which might be brought against the employment of the lower voltage. It is well known that with the best of the old type 50 volt lamps starting at 16 candle-power after 600 hours burning there will be obtained from those still in operation an average of only about 13 candle-power per lamp, and the energy required per candle will have risen fully 20 per cent above that required at the start. Among other things it has been the aim of the Westinghouse company to produce a stopper lamp of such a character that even in the higher voltages as satisfactory service may be obtained as from the old low volt types. As a result of very thorough tests which have been made of the 110 volt stopper lamp under the ordinary conditions of central station work, it has been found that after 600 hours it is stated to be a positive, though somewhat astonishing, fact that there is no fall whatever in average candle-power and no material increase in average watts per candle required.

Special attention has been given to the treatment of the carbon filament, as from the disintegration of this filament the loss of candle-power has arisen. The Westinghouse company claim not only to have overcome this important defect, but have succeeded in perfecting a process of building up the carbon while it is being burned. In other words, they are now able to produce a lamp in which the disintegration of the carbon is for a long time entirely counter-balanced by a continual building up of the carbon. The value of this feature cannot be too highly estimated.

Fig. 1 shows a group of lamps of various voltages as they are now turned out, and Figs. 3 and 4 are glimpses of the method of construction, Fig. 3 showing the process of molding the stoppers and Fig. 4 the glass blowing department, where the bulbs are manufactured.

The Westinghouse company have also perfected a line of what they term "adapters," as shown in Fig. 2, by the use of which all of the well-known sockets may be easily fitted for the stopper lamp. This feature will be found of great convenience to central station companies and dealers who supply customers having two or more styles of sockets in use. By this arrangement the supply of lamps necessary to be held in stock is materially reduced. When the lamps are used with the new Westinghouse socket, adapters are unnecessary, as these sockets were designed especially for the stopper lamps.

The attention of the company is now being especially devoted to the manufacture of 8, 10, 16, 20 and 25 candle-power lamps of the new design and 16 candle-power railway lamps.

FIG. 3.—MOLDING STOPPERS FOR WESTINGHOUSE INCANDESCENT LAMPS.

FIG. 4.—MAKING BULBS FOR WESTINGHOUSE STOPPER INCANDESCENT LAMPS.

MACHINE CURRENTS AND RAILROAD TELEGRAPH LINES.

READ BEFORE THE ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS, DETROIT, JUNE, 1894, BY J. W. LATTIG.

(*Concluded from page 20.*)

Since preparing the above the writer has installed the system with two Crocker-Wheeler motor dynamos at Easton, Pa., running one in the daytime and the other at night, thereby affording ample opportunity to clean and repair without disturbing our supply, and at the same time providing against mishaps by breakdowns. In case of a breakdown the other machine can be run continuously until the necessary repairs can be made. The machines run at 150 volts and the lines are balanced by German non-inductive coils, one short line having a resistance of 4,000 ohms in addition to its lamp. Machines are located on a shelf in the telegraph office directly under the eye of the manager, who cares for them. When running they cannot be heard five feet distant. As the Summer advances we expect to put a fan on the end of the shaft to ventilate the room, which is occupied by the dispatcher and a number of his clerks.

These machines cost, with wiring, rheostats and everything complete, $200. They replaced 162 jars of battery, which, at 57 cents each would make the net cost of installation about $108. They cost for current to run about $6.00 per month, or less than the cost of bluestone alone. We are, therefore, saving on this plant monthly about $10 in zincs, coppers and jars, to say nothing of the cost of attendance. The work of attendance was formerly assigned to one of our linemen, who is now relieved entirely thereof and can devote his whole time to the maintenance of the lines and other work with corresponding advantage to the service. These machines feed seven lines. The resistance of each of these lines with their instruments in circuit is 10,200, 6,220, 6,875, 5,430, 7,987, 5,944, 7,462, and all of them are as nearly balanced by resistance coils as possible. The current on them we try to keep at from 30 to 40 milliamperes. With a current greater than 40 milliamperes there is a tendency to "arc" at the keys on the switchboards and other contacts in circuit. It may be interesting to state that some of the above wires, before they were equipped with these machines, were not charged with over 12 or 15 milliamperes, and this state of affairs sometimes prevailed in spite of our efforts to maintain batteries in such condition as to feed the lines at about 25 milliamperes, the usual quantity where wires are fed by batteries.

Our experience with the results attained in this plant sharpened our desire to adopt the system at other small battery centers, but as there were no points on the line of the road where direct currents were available for running transformers, excepting 500 volt currents from street railways, which we hesitated to adopt, we were obliged to turn our attention to water motors. We accordingly ordered two 24-inch Backus water motors rated at one and one-half horse-power with water pressure at 75 pounds and two Crocker-Wheeler specially wound dynamos. The frames of these machines are their one-fourth horse-power type and the winding is designed to produce 150 volts and six-tenths of an ampere of current.

These motors we have arranged at Bethlehem, Pa., in such manner that either one or both can be run at the same time. The water-pipe is a two inch pipe from the street main, which is six inches in diameter to a point near the water motors. At this point it branches out in a "Y," one portion leading to the one water motor and the other portion to the other water motor, each being provided with a separate valve to control it. One of the machines is run in the daytime and the other at night. They feed eight wires and replace 200 cells of battery.

We found our water pressure to vary from 75 to 40 pounds, which caused the voltage to vary as much as 50 volts. It is needless to say that this variation was at first, before we tried it on our lines, a source of considerable anxiety; but, as we had provided the water motors with flywheels, which tended to reduce the suddenness of this variation, we found, contrary to our expectation, and, we may add, much to our gratification, that in practice the working of our lines was not in any way interfered with by these changes; in fact, the service was commenced upon the last day of the week, which had been continuously stormy, and on that day our business was handled with more ease than on any day of the week, our manager assures me equally as well as it had ever been handled during clear weather under the old battery system.

I do not wish to convey the impression that it is as well to have these variations as not, but I do say, surprising as it may seem, that no one has been able to detect it in the working of the lines, even in unfavorable weather. However, we realize that it is not best to have this variation and have decided to insert in the line of pipe leading to the water motors a pressure-reducing valve, which we shall adjust to stand continuously at the least pressure to which our water pressure falls. This will keep our motors at a constant speed, and consequently, our dynamos at a constant pressure. We are at present using a nozzle in the water motors of about $\frac{1}{4}$ of an inch in diameter, and the quantity of water is about five gallons per minute. For this we pay about $12.00 per month, so that there is a net saving in expense, to say nothing of the great advantages derived in the working of our lines. The water motors are provided with 10 inch cast-iron gear wheels and the dynamos with three inch rawhide pinions. The speed of motors is about 1,800 revolutions per minute.

The plant cost $285 with everything complete, except the pressure-regulating valve, which will cost $30. The saving in batteries should, of course, be deducted from this figure for the net cost, making it $201. This plant has proven itself so satisfactory that we have decided to purchase another of the same kind in every particular, to be located at Sayre, Pa.

In conclusion, I would recommend to the members of this association machine currents, with either water power or direct current transformers, wherever their service may require for as low as five or six wires, even on the ground of economy, to say nothing of the many advantages in other directions.

THE STORAGE BATTERY OF THE AIR.

BY PROF. ALEXANDER M'ADIE IN "HARPER'S MAGAZINE."

The air will stand a strain of about 9,600 grains per square foot before breaking. That is, the flash will occur when the electrical pull amounts to this, 1.37 pounds per square foot. For the energy of a cubic mile of strained air just before the flash we have, then, about 70,000,000 foot tons. The average thunder-head or cumulo-nimbus cloud is not a mile high, however. For a small cloud, one a hundred yards square, and distant only a quarter of a mile, we would get about 300 horse-power. Now a flash even a quarter of a mile long means a potential of many million volts. We cannot at present measure this directly, but we can determine the potential of the air within certain limits on any day, thunderstorm or no thunderstorm. In 1885, at Blue Hill Observatory, and in subsequent years, we measured the potential of the air with insulated water-dropping collectors, after the methods of Thomson (now Kelvin) and Mascart. The top of the hill is 600 feet above the surrounding country; but with Franklin's idea of reaching out a little farther from the earth, I ventured to use at times a large kite, tin-foiled, and for kite string some 500 feet of hemp fish line wrapped about with fine uncovered copper wire. During thunderstorms the sparkling and sizzling at the electrometer end of the kite string were incessant and startling. And even on cloudless days I found it possible to draw sparks, reading at the same time on the electrometer from minute to minute the electrification of the air in volts. In 1886 and 1887, in some investigations carried on by the Chief Signal Officer, and more immediately under the supervision of Professor Mendenhall, I experimented at the top of the Washington Monument, at that time the highest edifice in the world. The investigation continued many months, but perhaps days on which severe thunderstorms occurred were most impressive.

It being beyond dispute, then, that high potentials can be obtained from the air, the question naturally ensuing is, Can we not use them? With three or four sparks as small as those mentioned above, a large fruit jar can be cleared of smoke with which it has previously been filled. Perhaps nature repeats this on a large scale with lightning, and clarifies a foul dust-laden atmosphere with these great sparks. It may be, too, that these flashes are all needed, and to attempt to divert them would be unwise. Be that as it may, we are living in an age of "step-up" and "step-down" transformers; an age when, for the first time in centuries, we are perilously near duplicating lightning. Until recently we studied lightning only in miniature. Prof. Elihu Thomson was kind enough to show me in his Lynn laboratory, two Summers ago, some of his larger home-made lightning. Indeed, potentials of 100,000 volts are less rare to-day than potentials of 5,000 volts were five years ago. All who saw the Thomson and Tesla exhibits at the Electrical building, Chicago, will easily believe that it is within our power to turn the fleeting high-potential lightning into a current of lower potential and use it.

Professor Trowbridge, of Harvard University, in a discussion of some photographic negatives, shows that "the discharge follows exactly the same path in air for three hundred thousandths of a second," and adds that "it is probable that an ordinary discharge of lightning of a few hundred feet in length could light for an instant many thousand incandescent lamps if it were properly transformed by means of a step-down transformer." The eye alone cannot give a complete history of the myriad minor flashes during a thunderstorm. The charred though to us intensely brilliant crack in the air which we call lightning is but a great splash in the ether ocean. The waves and ripples come tumbling along in all directions, spreading rapidly, aye, very rapidly, nearly 200,000 miles per second. Given a proper resonator, and the waves will do work. If my reader keep every sense on the alert, he may happen on some strange illustration of work done by lightning, now all unsuspected. In the tinkling of the telephone bell, the blinking of an incandescent lamp, the melting of a fuse, or the tiny spark from a gas-pipe or loose wire, is the constant proof that there are more things going on between heaven and earth during a thunderstorm than most of us dream of in our philosophy.

Underground Systems Again.

TO THE EDITOR OF ELECTRICAL REVIEW:

I have read with much interest Mr. Hieatzman's letter published in your issue of July 11, 1894.

Indeed I am glad to see that my inquiry of May 16 has been read and induced some railway electrician to put himself on record, though I must also say that my question remains nevertheless unanswered.

So far I have found no one who has volunteered to explain what seemed to me a glaring disparity between English Siemens and United States Siemens agents, but perhaps they do not care to offer an explanation.

I am much obliged for the information tendered by Mr. Hieatzman and take the opportunity to assure him that I am somewhat familiar with the system described in the ELECTRICAL REVIEW, July 29, 1893, page 287; in fact I am a pretty careful peruser of one of the oldest and perhaps the best electrical journal of the United States.

Yours respectfully,
VICTOR M. BERTHOLD,
Member of Berlin Elektrotechnische Society.
Cambridge, Mass., July 12, 1894.

The directors of the American Bell Telephone Company were in session on July 11. Only routine business was transacted.

RESONANCE ANALYSIS OF ALTERNATING AND POLYPHASE CURRENTS.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, PHILADELPHIA, MAY 18, 1894,

BY M. I. PUPIN, PH. D.

I. INTRODUCTION.

The presence of upper harmonics in an alternating current wave is a fact which deserves careful consideration, both on account of the purely scientific interest which is attached to it, and also on account of the technical bearing of electrical resonance upon the construction of conductors possessing appreciable distributed capacity.

That alternating current and electromotive force waves of a great variety of forms can be produced by properly designing the pole-pieces of the field magnet, and the iron core of the armature of an alternator, is a fact nearly as old as the discovery of electro-magnetic induction. Fully as old is also the knowledge that a great variety of alternating current and electromotive force waves can be obtained by means of the induction of an intermittent current.

A careful investigation of these waves was first made more than 40 years ago by Lenz and Koosen, who employed alternators with iron in the armature. They plotted these waves from the instantaneous values of current and electromotive force obtained by means of the now well-known revolving sliding contact. Employing the same method of investigation Joubert showed in 1880 that the electromotive force wave obtained from an eight pole Siemens alternator without iron in the armature is very nearly a pure sine wave. The method is now known as *Joubert's method of sliding contact*. In 1888, Dr. L. Duncan showed how successfully this method can be employed in the study of alternating current waves produced by commercial machines in actual operation. The same method was considerably elaborated by Prof. H. J. Ryan in an investigation of the action of transformers. The name "indicator diagram," has been applied to wave curves of current and electromotive force obtained by Joubert's method, and very properly, I think, because they do very clearly indicate the action of alternating current apparatus. The process of taking these indicator diagrams has been shortened very much by Dr. L. Duncan's four dynamometer method.

Our knowledge of the action of alternating current apparatus has been extended considerably by these indicator diagrams.

For instance, we are now much more certain of the limitations which must be imposed upon the simple harmonic wave theory of alternating currents than we were a few years ago, and it looks very much as if progress in this direction, even more than in any other, meant progress towards a complete theory of the working of alternating current apparatus. Hence the desirability of as large a number of workers in this particular region of electrical research as possible.

There is no doubt that a simpler method would increase this number: for though much must be said in favor of the sliding contact method of obtaining indicator diagrams, yet it must also be acknowledged that the method is a very laborious and uninteresting process of investigation. A great many attempts have been made to devise some optical or some automatic method, but with little success. There is another reason why a new method of studying alternating current waves seems desirable. It is this: The method of sliding contact is not sufficiently sensitive to detect small deviations from a true sine wave, and consequently it is not capable of following up the causes of these deviations, when the effects seem to be absent. For instance, the primary current of a transformer can

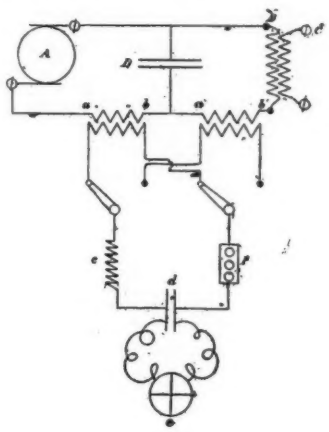

FIG. 1A.

differ very much from a true sine form when the secondary circuit is open, but when a large current is flowing through an approximately non-self-inductive secondary circuit, then the primary can be made to differ inappreciably from a true sine wave. *The question arises now, what has become of these causes when the secondary carries a heavy load?*

This question is of deep scientific interest; it is also of considerable technical importance. For, if these causes are present at all loads and only hidden by the principal wave, then, considering that these hidden small causes can produce large effects when conditions favoring resonance arise, it is evident that they must be carefully watched and guarded against in the construction of long lines possessing distributed capacity. I do not think that indicator diagrams obtained by the method of sliding contact are capable of giving a definite answer to this important question.

The method of analyzing alternating current waves by electrical reso-

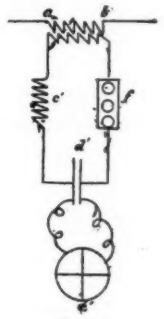

FIG. 1B.

nance which I employed in the following investigation was suggested by me a year ago. It is the object of this paper to describe this method at some length, and to illustrate, by some of the more definite results so far obtained, the simplicity, sensitiveness and reliability of the method. I shall also point out that this method of resonance analysis works quite satisfactorily even in those cases alluded to above, where the sliding contact method would, in all probability, fail.

II. DESCRIPTION OF THE METHOD.

Consider the following arrangement of circuits: A non-self-inductive resistance ab Fig. 1*a* is inserted in the circuit of an alternator A and the primary B of a transformer. In shunt with ab is a circuit, a, c, d, b, consisting of an inertia coil, c, of a large number of turns of copper wire of low resistance, about 10 ohms, but containing no iron, and a condenser, d, divided into sub-divisions ranging from .001 M. F. up. In shunt with the condenser d is an electro-static voltmeter e. The self-induction of the coil c can be varied by throwing a larger or smaller number of its sections into the circuit. The resistance can be varied by a rheostat f. Suppose now that the self-induction of c is kept constant, and that the capacity of the condenser is gradually increased from zero up. Whenever a capacity has been reached which, with the self-induction of the circuit, a, c, d, f, b, a, produces resonance with one of the harmonics in the main circuit, then the resonant rise of potential will produce a large deflection in the voltmeter. In this manner all the harmonics which are present in the current of the main circuit can be detected in the course of a few minutes. If the *resonator circuit* a, c, d, f, b, is placed in shunt with the non-self-inductive circuit (this circuit is denoted in Fig. 1 by a line beaded with asterisks and running from one pole of the alternator to the other) consisting of a bank of incandescent lamps, then the harmonics of the impressed electro-motive force can be detected in the same manner. The ratio of the amplitudes of these

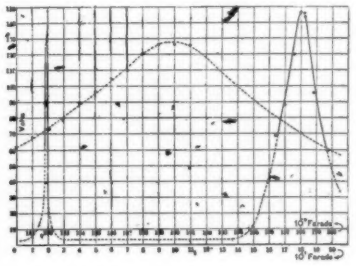

FIG. 2.

harmonics to that of the fundamental can also be determined by this method, if desirable, provided the conditions of the experiment are properly arranged. For let the current in the main circuit be

$$x = a_1 \sin pt + a_3 \sin 3\,pt + \ldots + a_a \sin a\,pt + \ldots$$

then the drop between a and b can be represented by

$$e = b_1 \sin pt + \ldots + b_a \sin a\,pt,$$

where $b_a = a_a r$,

and r = ohmic resistance between a and b.

Denoting now by

L the self-induction of the resonator a, c, d, f, b, a.

R the resistance of the resonator a, c, d, f, b, a.

C the capacity of the resonator a, c, d, f, b, a,

then it can be easily shown that the current in the resonator will be

$$y = \sum \frac{b_a}{\sqrt{a^2 p \left(\frac{1}{a^2 p^2 C} - L\right)^2 + R^2}} \sin (a\,pt - \varphi_a).$$

If, therefore, the capacity C is adjusted in such a way that—

$$\frac{1}{a^2 p^2 C} - L = 0,$$

then the circuit will be in resonance with the harmonic of frequency $a\,p$; and if L is sufficiently large and R sufficiently small (two conditions which are very easily fulfilled) then the current y is to within a small fraction of a per cent given by

$$y = \frac{b_a}{R} \sin a\,pt$$

The amplitude of the potential difference in the condenser which is measured by the voltmeter e is given by

$$P = \frac{a\,p\,L}{R} b_a.$$

In the same way we obtain for the fundamental frequency

$$P_1 = \frac{p\,L}{R} b_1.$$

Hence

$$\frac{P_a}{P_1} = a \frac{b_a}{b_1} = a \frac{a_a}{a_1}.$$

This gives the ratio of the amplitude a_a of the harmonic of frequency $a\,p$ to that of the fundamental. Let $a = 5$, then,

$$\frac{1}{5} \frac{P_5}{P_1} = \frac{b_5}{b_1} = \frac{a_5}{a_1}.$$

The voltmeter readings which give P_5 and P_1 magnify that ratio five times, in the case of the fifth harmonic, and it can be easily seen that a similar relation holds true for other harmonics. This is a very desirable feature of the method, considering that the amplitudes of the upper harmonics are generally small in comparison to the amplitude of the fundamental.

When quantitatively very accurate results are desired, then a low resistance, say one ohm, should be used for the section a, b, and an electrometer capable of giving a large deflection for about ten volts.

The principal interest, however, in the study of the distortion of alternating current waves is centered not so much in the exact ratio of the amplitudes of the harmonics to the amplitude of the fundamental wave, as it is in the causes producing these harmonics, and the conditions which modify the effects of these causes. Hence a quantitatively less accurate arrangement will do, provided that it is very sensitive, simple and easily manageable. Such an arrangement is given in Fig. 1*b*.

It differs from that given in Fig. 1*a* in the substitution of an air core transformer coil a', b', for the non-self-inductive resistance a, b. The secondary of this coil forms a part of the resonator circuit. For every harmonic of the inducing current we shall have a harmonic electro-motive force of the same frequency in the resonant circuit. By varying the capacity in the resonator and watching the voltmeter needle, we can tell, by the deflection of the needle, whenever we have reached the capacity which, with the self-induction of the resonator, brings this circuit into resonance with one of the harmonics. A reference to Fig. 2 will explain this more clearly.

In this figure the lower horizontal row of figures refers to the two-peaked curve, the upper row refers to the dotted flat-peaked curve. The vertical column denotes the voltmeter readings in volts. Consider now the two-peaked curve. It expresses the law of variation of the voltmeter readings when the capacity of the resonator circuit is varied from 0 to 2 microfarads, the self-induction being kept constant. The readings are recorded in Table I.

TABLE I.

Capacity in Motive Force.	Voltmeter readings in Volts.
.18	62
.181	68
.182	73.5
.183	79
.184	89
.185	96
.186	104
.187	110
.188	120
.189	126
.190	127
.191	125
.194	99
.198	71
.202	Very low
1.65	69
1.70	89
1.75	120
1.80	146
1.808	146
1.817	145
1.897	96
1.976	60

(To be continued.)

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Think of burning gas and having no electric fans in your office these hot days! Or, rather, don't think of it.

If the plans of its projectors are realized the system of trolley roads connecting New York and Philadelphia may prove to be a serious competitor of the steam railways between the two cities. It is expected that passengers, baggage and freight will be carried. With the advantage of frequent stops, a valuable tributary country and low expense of operation, freight rates *via* trolley should be lower than those on steam roads.

THE HERMITE SYSTEM OF TREATING SEWAGE.

Considerable interest has been manifested in England in the application of the Hermite system of electrolyzing sea water to the sanitation of towns. The system has been experimentally tested at Worthing, but only on a small scale. Doctor Kelly, the medical officer of health for Worthing, recently issued an unfavorable report of the results with the Hermite method in that town. It appears, however, that this report was premature, and the town council of Worthing did not adopt it. Doctor Kelly's conclusions were, moreover, entirely opposite to those of M. A. Piton, who reported favorably on the Hermite system to the municipal council of Brest. Another report on the recent experiments at Worthing has now been issued, dealing with both the chemical and bacteriological sides of the question. This document is lengthy and of considerable importance. It has been prepared by a special commission appointed by the proprietors of one of the principal medical journals, namely, the London *Lancet*. It will be unnecessary to enter into details concerning the investigations made by this special commission both at Worthing and in the laboratory. The conclusions of the commission will be sufficient. They are briefly as follows:

The electrolyzed sea water, whilst exerting a specific disinfecting action on the organisms, appears at the same time to be used up and destroyed to a much less extent by the organic matter present than any other disinfectant. The commissioners are quite satisfied from their examination of the effluent that the pathogenic germs, such as those of typhoid fever and cholera, would be effectually dealt with, as the more resistant bacterium coli commune appears to be destroyed. A strength of between 0.50 and 0.60 gramme of chlorine per litre is all that the commission consider necessary to effect the proposed objects of this method of sewage treatment. The adoption of any mixed system in which the house water, even without the storm water, is allowed to enter the drum in which the sewage undergoes treatment must always be accompanied by this danger * * * that the object of the system may be rendered futile from the fact that we must rely wholly upon the care and judgment of the household for the addition of sufficient quantities of the antiseptics from the sink. The application of the solution to the watering of the streets does not require serious consideration. The question of the flushing of the drains requires, however, further investigation as, although the direct antiseptic action would probably be small, the deodorizing and cleansing effects might have some value, but this can only be decided by direct experiment. The application of the system to hospitals in the complete form recommended by M. Hermite has much to be urged in its favor. The development of the Hermite system must be regarded as merely one of the signs of a distinct movement in sanitary science which for some time has been manifesting itself in other directions.

In France the telephone is used on many railroad main lines. On a portion of the Vincennes railway a rather novel system is in vogue, by which, at a given signal on the telegraph instrument, the operator connects the telegraph wires with a telephone for verbal communication. The large Austrian railways use field telephones, which may be connected with the telegraph wires at any point, without interrupting the telegraphic communications.

One of the guests on the "Faraday," which has just laid a new Atlantic cable for the Commercial Cable Company, was Count Von Slippenbach. We suppose he was taken along to be used if necessary to keep the cable from slippin' back.

Nothing knocks out hot weather like an electric fan. You can fill an office full of hot weather, add an electric fan and its wonderful how great a chilliness will ensue between the weather and the fan. Get into the chilliness and you are all right.

With the back-bone of the railroad strike broken and the possibility of an early settlement of the tariff question, manufacturers should get in line to supply the great demand for everything which must soon be in evidence. Better times are close at hand.

Summer resorts, outdoor spectacular plays, open air games at night and other Summer amusements all combine to make good business for the electric lighting and railway companies.

The possession of good eyesight is absolutely necessary to a motorman. Electric railways should be as careful in this matter as steam railways are in regard to engine drivers.

We regret to chronicle the illness of Prof. Herman von Helmholtz, who has suffered a paralytic stroke.

New York to Philadelphia by Trolley.

The electric railway to connect New York and Philadelphia, and pass through many of the cities and large towns between, bids fair to become a reality. On July 13 Frank A. Magowan, of Trenton, N. J., paid to State Treasurer George B. Swain $28,000, the amount required as deposit under the railroad law of New Jersey, and at the same time filed surveys, routes and descriptions, and secured a charter for the New York and Philadelphia Traction Company.

Mr. Magowan is president of the company, which is to have a capital of $10,000,000. Others interested are the Central New Jersey Traction Company, of which Mr. Magowan is president, and of which E. W. Hine, of Newark, is vice-president; J. H. Baldwin, of Newark, secretary; James H. Darrah, of Trenton, treasurer, and Col. D. K. Bayne, of New York; William H. Skirm, of Trenton; Joseph H. Real, of Bloomfield, and J. C. McNaughton, of Philadelphia, are directors.

There will be about 150 miles of electric railways. The road will begin at Paterson.

The projectors compute that they will acquire the patronage of 5,000,000 travelers, and transport much freight and merchandise. The great enterprise is to be managed by the new company and the Central New Jersey Traction Company. The latter has a capital of half a million dollars. Mr. Magowan says the rights of way have been secured and provision made for all the moneys required.

Work is to be begun at or near Trenton, and will be carried on in both directions. Seventy miles of local lines in different cities are to be merged into the system. The men interested in the enterprise own a valuable water right just below the falls in the Delaware, and contemplate using it in the production of the power needed to operate a large portion of the line.

Wall Street and the Electrical Stock Market.

A further recovery in prices is apparent to-day. In the week's earlier days the bear speculators made some slight impression on the price of stocks. Real holders continued, however, to refuse to sell, and on the break-down of the strike a steady movement of recovery set in. The bond market has been generally firm, but very inactive.

A big drop in Bell telephone was one of the features of the local market in Boston on Monday. Opening at 190, against last previous sale at 192, the price fell to 187 on sales of a little over 100 shares, mainly in odd lots. The drop was probably due to the impression on the part of some holders of long stock that sales of the new stock by auction will put down the price and that sales now may be made at a profit through purchases later at lower prices.

General Electric closed at 37½, having reached 38 during the week. Western Union closed at 84⅝.

New York, July 14.

GENERAL NOTES.

Hillsborough Bridge, N. H., wants an electric light plant.

The City Council of Newark, O., has granted a telephone franchise to Warren S. Weiant. He proposes a rental of $2 a month.

Worcester, Mass., Traction Company directors have declared a dividend of three per cent on its preferred stock payable August 1.

The municipal electric light plant at Newark, O., has been inspected by Professor Thomas, of the Ohio State University, and C. G. Armstrong, of Chicago.

The electric light and power house at Albert Lea, Minn., C. G. Edwards manager and principal owner, was burned on July 4. The dynamos were entirely destroyed. The loss is put at $8,000, with scarcely any insurance.

Lawyer John W. Wartman has stated that he intended to apply to the courts for an injunction to prevent the city of Camden, N. J., from entering into a five-year electric lighting contract with the Camden Lighting and Heating Company.

The comparative earnings of the Edison Electric Illuminating Company, of New York, for June were as follows:

	1894.	1893.	Increase.
Gross.....	$101,351.25	$85,611.17	$15,740.08
Net.....	52,504.20	34,197.89	18,306.31
For six months:			
Gross	$687,754.60	609,855.15	$77,899.45
Net.....	375,644.68	282,302.78	93,341.90

The United Electric Light, Heat and Power Company, of New York city, are putting up a new switchboard building which will be covered with an iron roof and the Berlin Iron Bridge Company's patent anti-condensation corrugated iron roof covering.

Justice Brown, of the Supreme Court, Brooklyn, N. Y., has refused the application of Taxpayer John Adamson for an injunction to restrain the Nassau Electric Railway Company and others from building tracks on certain streets of Brooklyn, under a franchise by the former Board of Aldermen.

Thomas Nevins, of Orange, N. J., the contractor who purchased the street railroads of Detroit, denied last week that he had done so in the interests of any syndicate. He said he bought the roads for himself, and personally closed the deal about two weeks ago. Mr. Nevins says he is going to organize a company and be at the head of it to operate the roads, and will give much of his own time to their management.

In pursuance of a call signed by Directors John E. Hudson, Joseph P. Davis, Edward J. Hall, W. D. Sargent and John Jameson, a special meeting of the stockholders of the American Telephone and Telegraph Company was held at the office of the company, 18 Cortlandt street, last week, for the purpose of voting upon a proposition to increase the capital stock of the company to $12,000,000, consisting of 120,000 shares of the par value of $100 each.

Rice & Sargent Engine Company.

Providence, R. I., has recently added a new name to the already long list of engine builders, whose reputation in this line has made her famous throughout the country. The new concern is known as the Rice & Sargent Engine Company, and is incorporated under the laws of the State of Rhode Island. The offices are located at 40 Codding street, Providence, and the officers are: R. A. Robertson, president; Z. Chafee, vice-president; John W. Sargent, secretary and Richard H. Rice, treasurer.

The two first named gentlemen are treasurer and president, respectively, of the Builders' Iron Foundry, one of the largest concerns of the kind in the East, and they have been prominently identified with engine building for the past 35 years.

Mr. Sargent is a practical machinist by trade, and at the same time a designer and draughtsman of unusual ability. He was educated at the Massachusetts Institute of Technology, and afterwards served a regular apprenticeship with the Swampscot Machine Company, of South Newmarket, N. H. He has been from time to time connected with such representative concerns as William Cramp & Sons, of Philadelphia, E. D. Leavitt, of Cambridgeport, Mass., and the Dickson Manufacturing Company, of Scranton, Pa. While connected with the latter company he designed the engines now used in the stations of the Edison Electric Illuminating Company, of New York, and the six 1,200 horse-power engines used to drive the New York cable road on Broadway. During 1893 Mr. Sargent was mechanical engineer of the Providence Steam Engine Company and designed the new cross compound engines of the Union Railroad Company, of Providence.

Mr. Rice is a graduate of the Stevens Institute, of Hoboken, N. J., and during the past four years has acted as mechanical engineer and superintendent of the Wm. A. Harris Steam Engine Company, of Providence. Mr. Rice has also had a large experience in draughting and designing, and has been connected, in this capacity, with such concerns as the Bath Iron Works, of Bath, Me., E. D. Leavitt, of Cambridgeport, Mass., consulting engineer for the Calumet & Hecla Mining Company, Henry R. Worthington and others.

The future of a firm composed of such men as the above is assured at the start, and the new engine which they are about to put on the market will soon create a reputation for itself, embodying as it does everything that is best in workmanship and design, backed by long experience, abundant capital and the best of facilities for manufacture.

The engines will be built at the works of the Builders' Iron Foundry, and special attention will be devoted to the requirements of the electric light and power field.

A 250 horse-power cross compound engine is now being built for the municipal lighting plant of the town of Marblehead, and the new concern is making a determined effort for some other large contracts in Boston and vicinity with excellent prospects of success. They are prepared to build all sizes of engines from 12 inch cylinders up, for any kind of service, either single, tandem or cross compound, triple and quadruple expansion.

An illustration and detailed description of the new engine, several important features of which are covered by patents, will be given in our columns at an early date.

PERSONAL.

Lord Kelvin celebrated his seventieth birthday on June 26.

Mr. J. M. Orford, of Boston, is expected to return from Europe about August 1.

Mr. Frank W. Hawley, general manager of the Cataract General Electric Company, has returned to New York after a European trip lasting several weeks.

Mr. C. O. Baker, Jr., the well-known platinum refiner, of Newark, N. J., returned East from Chicago last Thursday. Mr. Baker's train came out of Chicago under military escort, but this was because strikers were said to be around.

President Hudson, of the American Bell Telephone sailed from New York last Saturday for a vacation of about two months abroad. It is not probable that any meeting of the company will be called to consider the amendment to the charter of the company by the Massachusetts Legislature until his return, if then.

The Detroit, Mich., Public Lighting Commission last week held its first meeting of the new fiscal year. W. A. Jackson was nominated to succeed himself as president, but he declined on the ground of pressure of private business. He suggested R. H. Fyfe and Mr. Fyfe was elected. W. F. Conant was re-elected secretary.

Mr. William H. Browne, who has lately resigned his position as general manager for the United Electric Light and Power Company, has just been appointed receiver for the Flushing, Long Island, Railway Company. Mr. Browne's experience for the past six years makes him very fit for this position, as his duties have been wide and varied, and he has been extremely successful.

A New Plant at Palmyra, N. Y.

A contract has just been given out for an electric light plant at Palmyra, N. Y., the power being furnished by Canandaigua Electric Light and Railroad Company from their new water power plant. The electrical apparatus was sold by Mr. W. J. Morrison, agent of the Fort Wayne Electric Corporation, and consists of their well-known Wood arc and alternating dynamos, step-up and step-down transformers being used for the alternating lines. The Phillips Insulated Wire Company are to furnish 40 miles of their celebrated "O. K." weather-proof insulated copper wire. Mr. Morrison was instrumental in putting this deal through and deserves credit for his untiring efforts.

THE RIGHT OF PROPERTY IN AN IDEA.

READ BEFORE THE AMERICAN ASSOCIATION OF INVENTORS BY ALLEN R. FOOTE.

An idea unexpressed has no tangible existence. When published it becomes tangible, and in a sense ceases to belong to the person through whom it acquired form. It becomes the property of society. Property in the abstract is the creation of society. It consists of things of value which, by the consent of society expressed by its customs, its code of ethics or of laws, an individual is permitted to possess, enjoy and dispose of as his own. I say consent of society, because there could be no property if there were no social contract for its protection. The most important function of government, an institution of society, is the protection of life and property. The necessity for such protection is among the basic reasons why governments exist, and is the foundation for the right of governments to extract the revenues required for their support out of the property, the products of the lives they protect.

It would not be profitable on this occasion to enter into a detailed examination of the question of how property came to be, but it is vitally necessary clearly to state the principle, as we now understand it, upon which the rights of property rest.

Here is a definition quoted from Thomas L. Brown in *The Arena* for December, 1893.

"Wealth is a product of labor, or of labor and capital, applied to natural agents, *i. e.*, to land. True wealth as distinguished from 'illth,' always possesses actual or potential worth. Whether or not it possesses value depends, first, upon whether or not men recognize this worth; and second, upon whether or not they are able freely to steal it. Wealth recognized as such and placed beyond the reach of thieves, will always possess more or less value. The test must always be; can it be exchanged?"

This definition clearly shows that the property quality of things of value is created by the consent of society practically expressed through the protection afforded by the government instituted by, and acting for, society. If no one recognizes a thing as having worth, no one wants it, and, therefore, no protection is required to make its possession sure. It is not property. If a thing is recognized as having value, but possession of it by an individual is not confirmed by the consent of society, no one can own it, no one can exchange it for another thing of value because all persons are permitted freely to take it, therefore, it has no protection to make possession sure. It is not property. Things of value for the individual possession of which society does not consent to grant protection, are those things upon which no individual labor has been spent; they are natural resources enjoyed as a common inheritance. This observation brings to view the fact that society consents to grant protection for the individual possession of those things which are created by labor. This protection is the title deed of ownership and constitutes such things property. The right of ownership is the right of a creator to possess the products of his creation, his labor. This is fundamental justice, therefore the rights of property are the rights of protection granted by consent of society as a recognition of the principle of justice.

Protection issues from moral and physical forces. Barring the factor of knowledge, the absence of which may render one unable to determine to whom a thing of value rightly belongs, the most potent protection is afforded by a correct understanding of, and a desire to obey, moral law. When self-respect will permit no person to steal, there will be no stealing. The protection of property will then be complete without the presence or use of physical force. Once, when walking in Central Park, New York, I chanced to hear a few words exchanged between two young girls who were walking near me. Said one:

"Let's pick some flowers."

"Oh! I daren't," said the other.

"Come on, the policeman won't catch us, he is around the corner of the walk behind the bushes," said the first.

"I daren't catch myself stealing," replied the second.

If the high honor, the noble self-respect of that little girl controlled the actions of every person, stealing would be an unknown vice, the protection of property by physical force would be an unknown tax upon the industrious.

It is conceded that life is valued above all other possessions. It is clear that the protection of property is based on justice and is made most effectual by a correct understanding of, and desire to obey, moral law. The power to recognize these principles, and the disposition to be governed by them, raise man above the brute and constitute him a higher order of being. There can be no moral or economic science among brutes. In proportion as self-respect is strong or weak, asserting and maintaining a high standard of honor, or degrading, and it may be obliterating all honor in individuals and in society, will the rights of property be respected or disregarded. Regard or disregard for the rights of property determines the position of an individual in the scale of moral development from vicious brute to conscientious man. In proportion as regard or disregard for the rights of property is strong or weak, in individuals and in society, are men civilized or brutal, and in proportion as they are civilized or brutal, is the sacredness of life recognized and respected. A recognition of the rights of property is necessary to the protection of life. This is illustrated daily by the fact that men engaged in robbery do not hesitate to take life. "In true economic significance, labor and property are one."

"In isolation a man has undisputed possession of the surplus products of his labor. * * * The natural right of the isolated to the undisputed possession of the products of his labor, and to be unrestricted in the use or disposition he may make of it, cannot be enjoyed by associated men except as they are qualified by a due regard for the similar rights of others. This is the foundation of the natural law of labor and property. A natural law is universal in its application, therefore this law is binding upon all men."

"If, however, B, prompted by an ignorant self-interest, decides to take more than his just share of the product (the joint product of A and B), because he is the stronger and has the power to to so, such a violation of natural moral law removes the transaction from the domain of economic science, and carries it back to the domain of moral science. The brute must be taught the moral law, and have intelligence enough to understand it and honor enough to obey it before he can be dealt with as an economic factor."

The right of property inheres by the consent of society, not only to the products of labor, but to the acquisitions of close observation resulting in discovery. Such acquisitions closely approach the domain of invention. From this cause spring the multitudinous improvements on inventions. Observation of existing things suggests improvements and additional adaptations. These mark the growths of industry, facilities, comforts, entertainment and power to utilize the resources and forces of nature for the benefit of man. Out of the stock of common knowledge ideas spring, the known suggesting that which may be known. If a mind, taking a direction suggested by the known, projects itself beyond the border land of the discovered and broadens the sphere of human knowledge by making known that which was not before understood, the abstract right of property in the idea is as clear as though it were susceptible of being moulded into concrete form and placed upon the market as a new creation of manual labor.

These considerations bring to view another branch of the subject. If property is the product of society, of protection; if discovery, invention or ideas are suggested by observation of what others have done, what is due from the owner of property to society? The fundamental law of justice requires that property shall be held and used with a due regard for the similar rights of others; therefore, ownership is not a vested right. Ownership and use are not absolute. They are qualified by the principle of justice that gives them existence. In the abstract, the right of every person is to own and use as he pleases the products of his discoveries, ideas or labor. This abstract right can be fully exercised only when man is isolated. As soon as he becomes associated in any way with other men, his abstract right is modified by a due regard for the similar rights of others. By association society is formed. In isolation there is no property, as nothing is protected by the consent of society. The welfare of society requires that protection granted for the good of an individual shall not be used to the injury of society. Should it be, it would become the duty of society, in defense of its own welfare, to withdraw its protection and thus destroy the property.

The expense of protection, the expense of government, must be collected from property. Society in this behalf frequently exercises its sovereign power and dispossesses the owner of property by selling it to satisfy its claims for taxes, giving title to the buyer. Property rights that can be thus abrogated are not vested rights. They are not absolute.

If the discoverer, inventor or the author of an idea had been deprived of the opportunity to observe existing things, to draw upon the resources or forces of nature which are the property of no one, but a part of the common inheritance, or had been debarred from all access to the common stock of knowledge, is it conceivable that the discovery, the invention, the idea, would have ever been his? The principle of justice, which seeks to confirm to his use all that is rightfully his own, so long as such title does not conflict with similar rights of others, requires that he shall claim no more than his own. He must contribute to the social good full compensation for the benefits he has received from society, not only for the right to, and protection of, his property, but for the assistance he obtained from the common stock of existing things, from natural resources and forces, and from the common knowledge, in the way of suggestions, material and power. The man who causes two blades of grass to grow where but one grew before, and keeps both blades for himself, together with all knowledge of how he accomplished such a result, *is not a benefactor of his race.* His benefaction, if any, will be in proportion to the division of his extraordinary increase, made with others, and the extent to which his valuable knowledge diffuses itself through the common knowledge of society.

This reimbursement to society for benefits received, intangible and tangible, is a quantity that can be determined by no abstract rule of justice. The human mind is not yet sufficiently endowed with the power of judgment to enable it to do complete justice. It must be content to do substantial justice, being guided thereto by the rules of equity.

The laws and rules of the United States Patent Office are well founded on the principles of equity, recognizing both the rights of the individual and of society, giving the first benefit to the individual and the final benefit to society. The life of the individual is brief. The life of society is continuous. If there were never a question as to the right of property in discoveries, inventions or ideas, there would be, however, a necessity for the Patent Office and the system of laws and customs of which it is the exponent. On account of the fact that all discoveries, inventions and ideas are the outgrowth of suggestions from that which exists, it is a common occurrence that several persons will, almost simultaneously, honestly claim to be the original and only pioneer to lead an advance in science, literature,

art or industry. To make and keep correct records whereby conflicting claims so arising may be properly adjudicated is one, and if all men were thoroughly honest, would be the only function of the Patent Office. So founded and administered for such a purpose, society can well afford to broaden rather than to restrict the sphere of its operations.

It is a well recognized rule of procedure that the inducement should be offered for the thing desired to be developed. It is as well for society as for an individual that it should develop itself to the best of which it is capable. This is its right and its duty. If, therefore, by securing to the discoverer, inventor or originator of a useful thing or idea, for a part of his life, an opportunity to realize a profit, no matter how large it may be, for the profit cannot be out of proportion to its usefulness, society can succeed in stimulating all minds to do the best of which they are capable, it will not only enrich itself by the activity of living men, but through its endowment by inheriting their achievements.

In the main, all that has been said pertains to ideas that may be made tangible and imprisoned in concrete forms to which current value can be attached. They are of the earth. Beyond them, enveloping them, as the earth is enveloped by its atmosphere, there is a realm of thought that exists, oblivious of time and space as marked off by man-made instruments of precision. There the society of mind exists; a society in which property and death are unknown. There the wise of all ages hold communion. There the consent is given, not to protect, but that all things shall be free to those who are capable to receive them. From that society issue the forces that govern the affairs of men. For that society, the current values for which men so earnestly contend, have no meaning. In that society it is clearly understood that the things of greatest value are priceless and are offered without price. The treasures of wisdom need no guarding. They elude destruction. They increase by being shared. Long and painful seems to be the history of mankind, a panorama of the rise and fall of civilizations, but in the realm of intelligence the freed spirits of all ages and all races meet in the youth of an ever-living present; there some one understands it all. Admission to the society of mind is gained, not by birth nor by inheritance. It is open to merit only. Deception has no power there. "If you would hear the conversation of the wise you must learn to understand them. If you would speak with the wise you must become one of them." (John Ruskin.)

"It is the right and duty of every person to acquire for himself the best possible results from his life and labor. No man has the right to be any less than the best of which he is capable of being. The product of life is character. The product of labor is property. If life is eternal, so is character. Labor is perishable, so is property. The greater always includes the lesser. Every feature of the economic law of labor and property that tends to make man an economic factor of the highest value of which he is capable, is necessary to enable him to develop the highest possible character. Viewed intelligently, there is no conflict between economic and moral law. The reverse is true. Moral law is the foundation of economic law. Economic law completes moral law. One cannot be rightly observed while the other is being violated."

The right of property in ideas is founded on justice. Its recognition is dependent upon honesty. It is limited by a due regard for the similar rights of others. By granting protection to property society inherits the greatest benefits which human intelligence is capable of conferring.

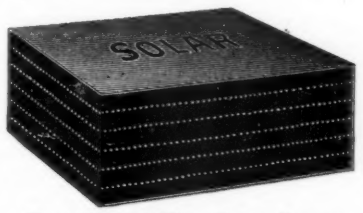
NOTE - The page references in this paper refer to the discussions of the economic principles involved in "The Law of Incorporated Companies Operating under Municipal Franchises."

Detroit City Council Must Approve Bids for the Lighting Plant.

A short time ago the Detroit, Mich., City Council asked for a mandamus to prevent the Lighting Commission purchasing apparatus for the municipal electric lighting plant without the approval of the City Council. The Michigan Supreme Court has granted the mandamus, which would seem to give the City Council the power it desires over the Lighting Commission. Unless the City Council ratifies the bids of the Western Electric Company for dynamos and the Brush Electric Company for arc lamps it is probable that these two bids will be rejected and new ones asked for.

The "Solar" Wire Gauze Carbon Brush.

The accompanying illustration shows the "Solar" wire gauze carbon brush composed of alternate layers of carbon and metal. Having the combined conductivity of copper and the lubrication of carbon and graphite, this brush is said to prevent the heating of the collector and to keep the



THE "SOLAR" WIRE GAUZE CARBON BRUSH.

commutator cool. The claims made for the "Solar" brush are great conductivity, low resistance, long life, and, as a result, a clean, bright commutator. The manufacturers are the Solar Carbon and Manufacturing Company, 95 Fifth avenue, Pittsburgh, Penn.

The Chicago Board of Fire Underwriters proposes to establish a bureau in the Northwestern States to collect and disseminate data regarding fires resulting from electricity; educate underwriters on electrical hazards; labor to secure uniform ordinances for electric wiring and installations, and maintain a laboratory in which tests will be made of electrical appliances.

A Portable Alternating Current Meter.

A portable instrument by means of which accurate measurements may be made of alternating currents is now being placed upon the market by the General Electric Company. It is small and handy and combines strength, permanency and reliability with compactness of form and excellence of workmanship. The scale is unusually long and reads to fine divisions. The instrument, although designed for alternating current

A PORTABLE ALTERNATING CURRENT METER.

measurements, may also be used for measuring direct currents, but for this work it requires special calibration. It is made in 25, 50, 100 and 200 ampere sizes.

LITERARY.

The author of the famous short story, "How the Derby Was Won," is Harrison Robertson, one of the editors of the Louisville *Courier-Journal*. He has written another striking tale for the fiction number of *Scribner's*, entitled "She and Journalism."

McClure's Magazine for August, following up Hamlin Garland's striking article in the June number on "Homestead and its Perilous Trades," will contain a study of life and work "In the Depths of a Coal Mine." It will be by Stephen Crane, and like the Garland article will be very notably illustrated.

"Alternating Current Wiring and Distribution," by Wm. Le Roy Emmet, E. E., Member A. I. E. E. 76 pages, 4½x7. Price, $1. Supplied by the ELECTRICAL REVIEW Publishing Company, 13 Park Row, N. Y.

It is the object of this valuable little work to point out, in a practical way, the laws governing the distribution of alternating currents, and it addresses itself particularly to practical men. In carrying out his programme the author first describes the various influences effecting alternating distribution, such as the surface or "skin" effect, the influence of neighboring alternating circuits, and the self-inductive effects, discussing each of these and showing the manner in which they must be taken into account in laying out lines in order to get the most economical size of conductors for the given amount of work. He next takes up the effects of transformers and motors in circuit, and shows by practical determination and an actual case how much the generator must be over-compounded in order to be self-regulating, and the voltage necessary on the line, the line losses, etc., in order to obtain the best working conditions. This is followed by two chapters on the methods of determining step-up and step-down transformers for long-distance transmission, including a discussion and application of the two phase and three phase transformer system. On the subject of alternating current wiring and town lighting in general there is much of value to the station manager. The intelligent application of the principles contained in this little work will save the electrical engineer and station manager not only considerable money but much annoyance. The questions here discussed are the most important now before the electrical community, and the author's wide practical experience in this field gives his work a special value at this time.

Steam and Electricity in Mining.

The General Electric Company's Power and Mining Department has received the following letter from General Manager Clark, of the Cœur d'Alene Silver and Lead Mining Company in Idaho, regarding an electric plant furnished to that company by the General Electric Company:

"In respect to the relative merits of steam and electricity at the Poorman Mine, I will say that the amount saved in fuel is about $100 a day. This, of course, is due to the fact that we generate electricity by water power. How electricity would compare with steam in the matter of cost, if the former were generated by steam power, I am not prepared to say, but am of the opinion that where steam has to be transmitted a long distance underground, particularly where it is wet, that electricity generated with steam and transmitted to the pumps or other machinery will be found to be the most economical, the percentage of loss in transmission being so much less; in addition to this, the cumbersome steam pipes with their destructive effect on shaft timber is avoided. We have five machines in use: two 175 kilowatts at the generating station, one and one-half miles distant from our works, where they are operated with Pelton wheels under 800 feet head; one 175 kilowatts to drive our concentrator; one 150 kilowatts machine for the pump, raising 500 gallons of water per minute 500 feet; and one 175 kilowatts for the compressor. This system has been almost two years in operation."

Siemens & Halske Apparatus in New York City.

On the first page of the ELECTRICAL REVIEW for July 4 mention was made of certain Armington & Sims engines used in some of the large office buildings in New York city. A reference is also made to the combination shown of engine and generator. The article in question seems to imply that the General Electric Company's generators are used in all of these places. The Siemens & Halske Electric Company, of America, state that in only one of the places mentioned is apparatus of the General Electric Company in use, notably the Manhattan building. In the other places mentioned, to wit: Chas. Broadway Rouss, Home Life Insurance Company, Eye and Ear Hospital and Mutual Reserve Fund Life Insurance building, the apparatus of the Siemens & Halske Company is in use in connection with Armington & Sims engines.

Rear Admiral Fleuriais's Electric Log.

M. Fleuriais's log, tried in 1878 on board the "Magicienne," was fitted with four hemispherical cups, like Robinson's anemometer, of which it was an adaptation. A circuit-closer mounted on the axle sent the current from a battery at first into a telephone and afterwards into a bell; the crackling of the membrane or the strokes on the bell showed the number of turns in a given time, and a converting table prepared beforehand gave the speed of the vessel. But when this speed increased, starting from about 12 knots, the strokes of the bell produced at each revolution of the vanes were so accelerated that it became difficult to count the exact number, and thus errors arose which were too great for approximate calculations.

M. Fleuriais, therefore, modified his former model, and the new log tried on board the "Ocean," the "Duguay-Trouin." the "Cécille," and lastly, the "Wattignies," has been adopted by the French navy after these trials. This new log is described by Georges Dary, in *La Nature*. A translation of the article, from which this is taken, appeared in the London *Electrical Review*. The apparatus measures .247 metres in diameter and consists of two similar sets of four cups A, A^1 (Fig. 1); the cups being thus eight in number, the rotating couple has such an energy that the slight variations in the passive resistances remain absolutely without influence. The axle has in the middle a deep screw; this screw engages in the teeth of a wheel, the surface of which is covered with an ivory disk which has three metal contacts; on this disk a spring *r* presses, which is fixed to the conductor C, formed of seven fine wires. This spring is coated with Chatterton's compound, except its extreme end, which, being fitted with a silver button, remains bare so as to establish good contact between the wheel and the electric conductor.

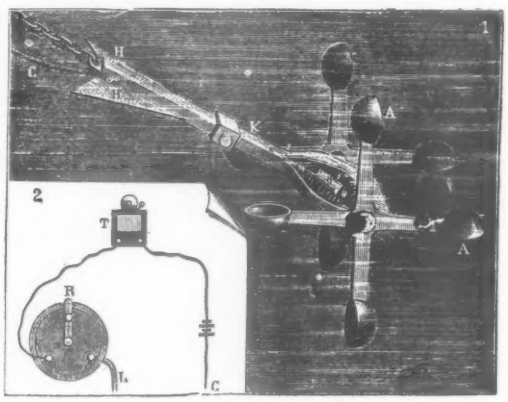
The whole is enclosed in a bronze case with a cover which allows free passage to the water, but keeps out rubbish, weeds, etc.

The bearings of the axle are of ash and also the jaws which hold the conductor firmly in the tube in which it is enclosed.

The log terminates in two bent wings H, H, which ensure the immersion of the apparatus towards the bottom; the action is that of the Japanese kite reversed. This last idea was suggested by M. de Maupeon, director of naval construction.

The towing line consisted at first of a cable of four strands, one of which was removed and replaced by the conductor; but as there was always a chance of the wire becoming twisted notwithstanding the fastenings of sail-twine which were made at each metre, M. Fleuriais adopts in preference a metal towing-line, which, at the same time, reduces the friction of the water, and consequently the traction, as much as possible. On board there is always a commutator acting in two directions (Fig. 2), one of which is the position of rest R, a bell T, and two Leclanché elements, the positive pole of which communicates with the keel at C.

When the log is submerged the vanes revolve and the screw works the toothed wheel. Everytime the spring passes over one of the metal contacts, the circuit is closed and the bell sounds; but as this wheel has 72 teeth and three contacts, the bell only sounds once for 24 revolutions of the vanes. The intervals between two successive signals, 11 seconds for 8 knots, 8.8 seconds for 10 knots, 4.4 seconds for 20 knots, will thus be sufficiently great to prevent mistakes, and will enable the speed to be calculated with the greatest accuracy. In order to reckon seconds and fractions of a second M. Fleuriais has abandoned the sand-glass for a pendulum indicator which beats at intervals of two-tenths of a second, and which is started at the moment an observation is being taken. Assuming that we make a mistake of half a second, if we take a period of 50 seconds, the error will only be .1 of a knot in the speed of a vessel. But the observation may be prolonged, and thus the error may be reduced indefinitely.



FIGS. 1 AND 2.—FLEURIAIS'S ELECTRIC LOG.

Unlike other systems, the circuit closer of the Fleuriais log is not enclosed in a water-tight box.* In this case, as soon as the commutator is submerged, it being closed, the battery works, since the current passes through the sea, the log and the conductor; nevertheless, the loss by the sea is not considerable, and the current has not then sufficient energy to ring the bell, which only rings at the moment the spring touches one of the contacts.

But with this arrangement M. Fleuriais had to devote all his attention to the perfect insulation of the single conductor, a precaution indispensable to the good working of the apparatus, but one which was not so essential with a water-tight box and an entirely metallic circuit, as in the Coffinières system, and the logs invented by Faymonville, Lopez de Hare, etc. Moreover, as registering logs are intended to be for the most part, if not always, under water, we must say that a water-tight case has the advantage of preserving the wheels from deterioration, either by the water or by the introduction of foreign bodies, however small they may be. The recent experiments made at Cherbourg by the "Davoust" showed that after 18 knots the log rises too near the surface, notwithstanding the curved wings. Sometimes the cups emerge from the water and, consequently the speed of rotation varies. Nevertheless, in its present form, and whilst awaiting the test of long and frequent use, which might suggest fresh improvements to the learned admiral, the log, with double vanes, gives such close approximations to the truth that it will render useless and do away with trial trips on measured bases, known distances that serve in experiments to determine the speed of ships.

This arrangement, which answers excellently at the islands of Hyères, is, as M. Fleuriais observes, far from satisfactory, both from a theoretical and practical point of view, in other localities.

*The Granville electric log manufactured by Messrs. Elliott Bros., and fully described in the No. of the REVIEW for January 30, 1891, has the contacts unenclosed.—LONDON ELECTRICAL REVIEW.

The "Acme" Portable Voltmeter.

Queen & Company, of Philadelphia, report that for months past they have held back from the market a new type of portable voltmeter for both alternating and direct current circuits, in order to give it a thorough time test. They are now satisfied that the instrument is thoroughly adapted to laboratory as well as station measurements and are preparing to manufacture it in sufficient quantities to meet the large demand which seems assured so soon as the merits of the voltmeter become known. It operates on the "hot wire" principle and is absolutely free from hysteresis error, thus being correct for alternating circuits of any frequency. It is dead beat without a mechanical brake—a most important feature—and is the most compact, reliable instrument of its class made. Twenty different ranges cover potentials from two volts to 3,000 and by means of a special interchangeable adapter which fits the Edison, Thomson-Houston or Westinghouse system, measurements can be made very rapidly. The "Acme" voltmeter received the highest World's Fair award because "It possesses high sensibility over the entire scale and its zero is not affected by changes of temperature. The instrument is unusually compact and portable." For more detailed information see an extended article in the ELECTRICAL REVIEW for February 28, 1894, entitled "The 'Acme' Standard Voltmeters for Direct and Alternating Circuits."

The Twin Screw Steamer "City of Lowell" of the Norwich Line.

The new twin screw steamer "City of Lowell," of the Norwich and New York Transportation Company, Norwich Line, was placed in commission on July 10, making her first regular trip from New York. She will leave New London on arrival of the vestibuled steamboat express train of the New York and New England Railroad every Monday, Wednesday and Friday, and the popular steamer "City of Worcester" will be in commission on opposite nights.

The "City of Lowell" was built at the Bath Iron Works, Bath, Maine, from which some of the finest vessels in America have been turned out, and was designed. by A. Cary Smith, the well-known and successful steamboat and yacht designer of New York. She is modeled after the fast and noted Sound steamer "Richard Peck," which was also designed by Mr. Smith, and her hull is constructed entirely of steel, with four complete transverse water-tight bulkheads. She has five decks, lower, main, saloon, gallery and hurricane. She is 336 feet and one inch long over all with a beam of 66 feet and a tonnage of 2,400. The saloon deck is entirely given up to the accommodation of first-class passengers, and has 81 double-berth staterooms and 25 rooms with brass bedsteads, in which one can rest with "all the comforts of home."

The total estimated initial horsepower of the engines is, including all auxiliaries, 4,600, which, with 125 revolutions per minute, is designed to develop a speed of 20 knots, or over 23 miles per hour. The electric plant consists of two units, each including a large dynamo and 70 horse-power straight line engine. Each unit is capable of lighting the entire ship, there being 700 lights, and also a powerful search-light of the most approved pattern on the pilot house. The electrical plant is placed in the main engine room, and the dynamo and engine are connected by a belt.

The First Telephone Exchange.

TO THE EDITOR OF ELECTRICAL REVIEW:

I note in the ELECTRICAL REVIEW of July 11, 1894, on page 15, a paragraph which begins with this sentence: "Fifteen years ago, there was not a telephone exchange in the United States." I suppose you desire to be accurate in your statements, and I beg to say that 15 years ago, July 11, 1879, the New Haven, Conn., exchange was one year, four months and 13 days old. The Meriden exchange was something over a year old, and I believe a little inquiry will show that in Massachusetts, several exchanges were already in active operation. I have on my mantel, in my office, the first list of subscribers of the New Haven exchange, which is dated February 21, 1878, and contains just 50 stations, 32 of which are still in operation. We have still on the payroll of the company, the name of one man who entered the employment of the New Haven exchange on the first of March, 1878, and has been with us continuously ever since.

I am, yours very truly,
MORRIS F. TYLER,
President Southern New England Telephone Company.
New Haven, July 12, 1894.

The Lewis Arc Lamp.

The arc lamp is still the subject of improvements at the hands of many inventors, although but few notable inventions are to be found among the many so-called new arc lamps continually brought to our notice. In this new lamp, says the London *Electrical Review*, we believe quite a novel mechanism has been applied to operate the feeding of the carbon and the striking of the arc. In it there are two mechanisms combined, one to strike the arc, the other to effect the feeding. Both are controlled by one electro-magnetic appliance, which is preferably a solenoid with a freely floating core, and the beauty of the combination consists in the absolute independence of the striking gear from the feeding gear, despite the fact that both are combined in one and governed by one electro-magnetic device.

The mechanism consists of three mitre wheels as shown in Figs. 1, 2

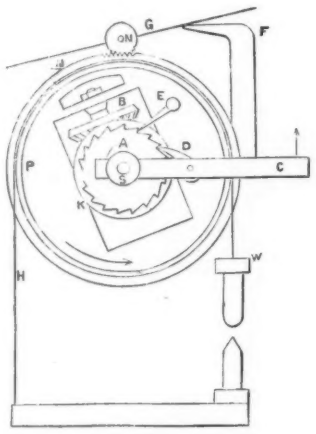


FIG. 1.—MECHANISM OF LEWIS ARC LAMP.

and 3. Fig. 1 shows the striking side of the mechanism in diagram; C is the lever which is worked up or down by the core of the solenoid; *d* is a pawl engaging into the ratchet wheel *a*; *e* is a fixed pawl attached to the framework which keeps A from running back; A is fixed on the back of one of the mitre wheels K. The lever C and the ratchet and mitre wheels are all loose on spindle S, which is not movable. It will be evident if we work the lever up the ratchet and mitre wheel will be moved round. The mitre wheel K gears into another mitre wheel B, which is loose on a stud fixed in the pulley P, over which the carbons are hung, and this mitre wheel B gears into another mitre wheel on the other side which is fixed to a large toothed wheel M, as shown at O in Fig. 2, which illustrates the feeding side of the mechanism. These wheels also revolve loose. On the spindle S into the large toothed wheel is geared a pinion N, carrying a fly G, which, upon the rise of the lever C, locks, by means of the detent F, the wheels M and O at an early point in the upward movement of the lever. Now, if one of the mitre wheels is locked in this way and the lever continues to rise, pulley P will be rotated on the spindle S on which it is loose, mitre B rolling on the fixed mitre O and being driven by K. This rotation of P evidently parts the carbons and forms the arc, and thus the arc strikes. Now, for the feeding: The fixed pawl will keep the ratchet A from running back when the lever C descends as the arc

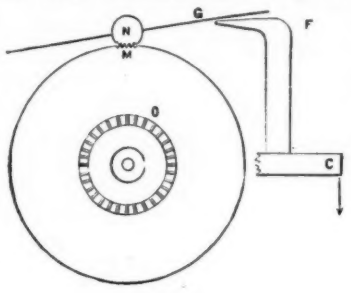


FIG. 2.

burns open and the solenoid allows the core to fall, but at a certain point in the fall of lever C, detent F lets the fly go, releasing the mitre and wheels on the feeding side, so that pulley P can move back. A and K being locked by E, mitre B rolls now on K, being pulled round by the preponderating weight of the upper carbon holder W; but immediately the arc closes the least bit, lever C is pulled up and stops the fly, thus locking pulley P again. This action of the lever and fly is so quick that only half a turn of the fly is allowed at a feed.

It is obvious that between the feeds the whole mechanism is absolutely locked; A is locked by pawl E, and O is locked by the detent and fly, so that no vibration can affect the steadiness of the arc.

In these figures the lamp is shown as a focussing lamp, but in Fig. 3 a complete lamp of the coiled band type is shown. The large toothed wheel M can be seen gearing into the pinion, and two of the mitre wheels B and A can be seen on the striking side.

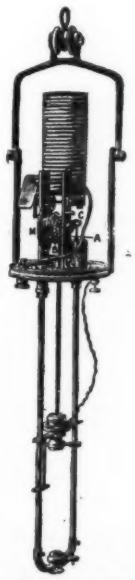


FIG. 3.—LEWIS ARC LAMP.

The lever C is made double and weighted to balance, and a dash-pot is attached to it as shown at Y. This dash-pot is a dry one, and acts only at the moment of striking the arc, as it is worked by a pin in the lever C in a slot, so that when the lever decends to near the feeding point the piston rests on the bottom of the pot, and the lever works free, as the pin moves in the slot on its further downward course.

This is an extremely neat arrangement and acts to perfection; and it is not likely to miss feeding or get out of order.

The lamp shown is a single coil lamp for running in simple parallel on a 50 volt alternating circuit. It will be clear that any kind of lamp can be made with this gearing merely by substituting other electro-magnetic devices for the single coil.

Is Fred. Gower Alive?

It was reported in Boston and Providence last week that Fred. A. Gower, of Bell telephone fame, and husband of Mme. Nordica, the prima donna, was alive. The story of his appearance in London came to Boston in a private letter, the reference to Mr. Gower being couched in substantially these words: "What do you think! Fred. Gower has reappeared here; won't there be a time now?"

Frederick A. Gower was a well-known man about town in New York city 15 years ago. That was before he married Lillie Norton, or Lillian Nordica, as she is known now. He was on the staff of a newspaper in Providence when he was engaged to assist in booming the Bell telephone. His work in this direction was most successful. The company paid him well for his services and later he obtained an interest in the business. He lived in fine style at the Fifth Avenue Hotel and spent his Summers at Newport. Then he went to Paris for the telephone company, and in 1882 he met and married the prima donna. Their married life was not happy, and in 1885 Mrs. Gower, who had returned to this country, began suit for separate maintenance. While this was in progress Gower, who was an ardent amateur æronaut, attempted to cross the English Channel in a balloon. He disappeared and was thought to have been lost. Since then, however, there have been several reports that he was alive and had been seen in various parts of the world. At the time of his disappearance he was estimated to be worth $500,000, and after considerable litigation Mme. Nordica, whose claims were opposed by her husband's relatives, waived all her rights in consideration of $40,000 in cash.

Large Electric Transmission Plant in Norway.

A syndicate has lately applied to the Norwegian Government for a concession for an electric power transmission of some 20,000 horse-power from the Raanaas waterfall at Sörum and the Fossum waterfall at Askim, to the town of Christiania. It is understood, says London *Engineering*, that the plan of the installation is made by an English electrical engineer and approved of by Lord Kelvin. It comprises the transmission of 20,000 horse-power to Christiania from the above two falls, but it is proposed to commence with a transmission of 10,000 horse-power. The tension is not to exceed 10,000 volts. The length of the line from the Fossum fall is close upon 25 miles; it passes through Spydelizerg, Tomter, Ski and East Aker. The other, the Raanaas line, is about a couple of miles shorter, and passes through Sörum, Skedsmo and East Aker. At the borders of the borough of Christiania, it is intended to build a distribution station, where the high tension current will be transformed and distributed to the various parts of the town by means of underground cables, the proposed tension varying from 100 to 400 volts. The installation cannot only supply convenient and cheap power for the larger and smaller industries of the town, but it is also under contemplation to supply the whole town of Christiania, or at least the part of the same which is not lighted from the central electric station, with electric light at a cheap price. The lighting of the public thoroughfares will, according to the plan, be effected by arc lamps of 2,000 and 1,000 candle-power, according to the importance of the street, and the price will be much cheaper than that charged by the present central station. There will be several large turbines at each waterfall, which are some of the most important in Norway, and the high tension will be generated either direct or by transformers. It is proposed to use naked wires. The installation can, it is calculated, be completed in the year 1895, although much will depend upon the water level of the waterfalls, as the works in connection with leveling, damming, etc., require low water. The cost is calculated as 6,000,000 kreutzers, or about 350,000 pounds.

American Rapid Telegraph Company Sold.

The Western Union Telegraph Company has purchased the American Rapid Telegraph Company and has increased its capital stock 5,500 shares in payment for the same. The lines and property of the American Rapid Telegraph Company consist of 2,684 miles of poles and 20,370 miles of wire, extending from New York city to Boston, Buffalo, Cleveland, Pittsburgh, Chicago, Washington and intermediate points, with office equipments, rights of way, etc.

The capital stock of the company was $3,000,000 and its bonded debt $3,000,000. The company defaulted on its interest and the property passed into hands of a receiver, who leased it to the Western Union at a rental of $60,000 per year. The property was sold under foreclosure March 11, 1891, and purchased by a committee of bondholders, which has recently sold it to the Western Union Telegraph Company. The Western Union Telegraph Company, it is stated, will pay about $500,000 for the American Rapid Telegraph Company, and this, together with about $300,000 held by the receiver of the American Rapid Telegraph Company, will give the bondholders of the Rapid Telegraph Company a dividend in the neighborhood of 27 per cent of the par value of their bonds.

KINDRED INTERESTS

The Westinghouse Electric and Manufacturing Company, it is reported, did a business of over $500,000 in June and the prospects are that July will make a still better showing.

It is Probable that the tube shop at the General Electric Works, Schenectady, recently destroyed by fire, will soon be rebuilt. Other new structures are said to be necessary by the removal there of departments from Lynn.

The United States Projectile Company, at Brooklyn, N. Y., are making extensive additions to their machine shop, and have placed the contract for this work with the Berlin Iron Bridge Company, of East Berlin, Conn.

The Brown & Sharpe Manufacturing Company, Providence, R. I., will close their works from August 6 to August 18, inclusive, for annual vacations and repairs. The office will be kept open as usual, and all orders will be promptly filled for machinery or tools described in their catalogues, and usually kept in stock.

The General Electric Company has issued a very pretty folder replete with illustrations and descriptions of its electric railway apparatus. The folder, which is handsomely printed in two colors, is especially devoted to the Intramural Elevated Electric Railway which the General Electric Company installed at the World's Fair.

The Contract for furnishing 1,800 horse-power of cross-compound condensing engines for the Second Avenue Traction Company's new power plant, located at Glenwood station, near Pittsburgh, was awarded to Russell & Company, of Massillon, Ohio, through their Pittsburgh manager, Mr. F. G. Borden. The contract amounts to about $30,000.

Queen & Company, incorporated, of Philadelphia, have a new form of central station voltmeter, which should meet with much favor. The dial is arranged in the shape of a semi-circle 14 inches across, and the scale covers 180 degrees accordingly. Thus it will be evident that the divisions are far apart so that small fractions of a volt can be easily read at some distance. An adjustable index which can be set at any desired point is also supplied. This voltmeter can be left in circuit all day long without injury and is described in circular No. 535 which the makers will mail upon request. They also have a full line of switchboard instruments for isolated plants.

The St. Louis Railway Company, of St. Louis, Mo., have placed the order for their new car barn with the Berlin Iron Bridge Company, of East Berlin, Conn. The building will be 64 feet in width, and 185 feet in length, with brick walls, the roof being of iron, covered with the Berlin Iron Bridge Company's patent anti condensation corrugated iron roof covering. It is the intention of the railroad company to make this station absolutely fire-proof and thereby save insurance. There will be no woodwork used in the construction of the building, and it will not be necessary to carry any insurance whatever, as the danger from fire is entirely eliminated.

Electrical Men everywhere are up to date. Philadelphia, generally speaking, is regarded as slow, but her electrical men are her liveliest citizens. Partrick & Carter, of South Second street, is one of the old conservative, always alive, concerns that stands for Philadelphia's electrical industries. This concern has stood the test of time. Mr. C. M. Wilkins, one of the firm, lately told a representative of the ELECTRICAL REVIEW that he had heard a rumor to the effect that hard times were quite prevalent, but that they had not yet appeared down Chestnut street as far as South Second. Probably, if they do get within hailing distance, Mr. Wilkins will shoot them down the trolley wire on Chestnut street clear into the Delaware, by means of the switch, "Good business methods." This switch, with this concern, is pretty old, having been in service for many years, but she's just as good as new and probably better for she has limbered up in all respects to fit the situation.

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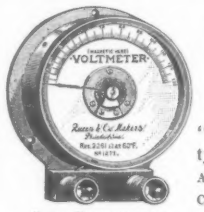

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